High efficiency UTC Photodiode for High Spectral Efficiency THz links

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Due to an increasing demand of data transmissions capability, the THz band, precisely beyond 200 GHz, has been shown to be very interesting to pave the way for next generation wireless communications [1]. While potential standard currently investigated is the 100 Gbit/s data rate [2], proof of concept using photonics-based THz emitters (photomixers) and broadband receivers already lead to early advanced demonstrators [3]. In this work, a high-efficiency/high power photomixer based on unitravelling carrier (UTC) photodiode is presented, and a first THz link using this device. In the proposed device, a semi-transparent top contact based on sub-wavelength apertures covering a large fraction of the UTC-PD surface with metal is used, resulting in a small contact resistance and high transmittance at 1.55 µm. The contact consists of parallel metallic strips of width w, aperture a, and metallization height h. Fig. 1 shows the topology of the device, as well as parameter set used for top-contact. A resonant cavity with metallic mirror under photodiode was used in these devices in order to increase the responsivity. For example, Fig. 2 shows that the measured RF power for a 3*3 µm² device was > 600 µW at 300 GHz, for a 8.5 mA current and -1 V bias. The fabricated UTC-PDs were used for wireless communications at 300 GHz. For a link of about 1.5 meter, a 4*4 µm² UTC-PD, QAM-16 constellation was successfully recovered at 32 Gbit/s using a limited optical power around 20 mW.

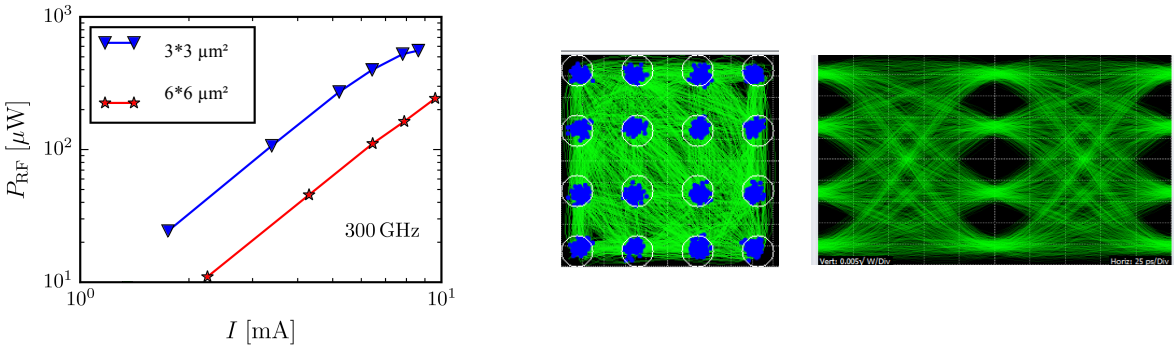

Fig.1. Output power of the UTC-PD device and QAM-16/eye-diagram after 1.5 m propagation distance.

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References

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